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[Intervention Review]

Bed rest for acute uncomplicated myocardial infarction

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ABSTRACT

Background

Bed rest is prescribed to all patients with acute myocardial infarction (AMI), but to a variable extent. Current guidelines (American College of Cardiology/ American Heart Association) recommend at least 12 hours bed rest in patients with uncomplicated ST-elevation myocardial infarction, however the basis for this recommendation is unclear.

Objectives

To compare the effects of short versus longer bed rest in patients with uncomplicated AMI.

Search methods

We searched the Cochrane Central Register of Controlled Trials (*The Cochrane Library* 2009, Issue 3), MEDLINE (January 1966 to October 2009), EMBASE (January 1988 to October 2009), PASCAL BioMed (January 1996 to August 2005), PsycINFO (January 1966 to October 2009) and BIOSIS Previews (January 1990 to October 2009). Bibliographies were checked. No language restrictions were applied.

Selection criteria

Randomised and quasi-randomised controlled trials of short versus longer bed rest in patients with uncomplicated AMI were sought.

Data collection and analysis

Study selection was performed independently by at least two investigators according to the predefined inclusion criteria. Data were extracted by two investigators independently and in duplicate. Authors were contacted to obtain missing information.

Main results

We found 15 trials with 1487 patients assigned to a short period of bed rest (median 6 days) and 1471 patients assigned to longer bed rest (median 13 days). Generally the studies were outdated and appeared to be of moderate to poor methodological reporting quality. There was no evidence that shorter bed rest was more harmful than longer bed rest in terms of all cause mortality (RR 0.85, 95%CI 0.68 to 1.07), cardiac mortality (RR 0.81, 95%CI 0.54 to 1.19), or reinfarction (RR 1.07, 95%CI 0.79 to 1.44).

Authors' conclusions

Bed rest ranging from 2 to 12 days appears to be as safe as longer periods of bed rest. The quality of most trials is unsatisfactory. Current bed rest recommendations are not supported by the existing evidence as the optimal duration of bed rest is unknown. The lack of adequate trials is surprising, considering the large size of several studies to compare effectiveness of drugs on people with AMI.

PLAIN LANGUAGE SUMMARY

Bed rest for acute uncomplicated myocardial infarction

Bed rest is an inherent part of treatment for acute myocardial infarction (AMI). In clinical practice this intervention is prescribed in different ways and for different lengths of time. Current guidelines recommend at least 12 hours bed rest following AMI. However the basis for these recommendations is unclear. This review found 15 trials which were generally outdated and of moderate to poor methodological quality. Bed rest ranging from 2 to 12 days appears to be as safe as longer periods of bed rest. No evidence was found to support the current bed rest recommendations of not more than 12 to 24 hours. The optimal duration of bed rest after AMI remains undetermined from the available evidence.

BACKGROUND

Each year, a total of about 1,100,000 people in America experience acute myocardial infarction. Accordingly, the estimated direct and indirect costs for coronary artery disease were about US \$111.8 billion in 2002 (AHA 2001). Bed rest is an implicit part of the early therapy in patients with acute myocardial infarction (Allen 1999). The principle idea behind this intervention is to reduce myocardial workload, avoid further perfusion impairment of the myocardium and minimise remodelling (Wenger 1978). Most complications occur within the first 48 hours after acute myocardial infarction (Spracklen 1968). Therefore monitoring is essential for this period. As most monitoring devices are designed for recumbent patients, bed rest is often understood as a necessary condition to enable monitoring. On the other hand immobilisation in itself may adversely affect patients outcomes, e.g. by increasing the risk for thromboembolic complications (Maurere 1971), especially in patients with myocardial insufficiency (ESC 2003). Prolonged bed rest may also decrease morale or well-being, which is an important factor for rehabilitation and return to work (Bloch 1978). In addition, prolonged bed rest may occupy beds and personnel unnecessarily, which may lead to bed shortages for acutely ill patients.

The first approach to early mobilisation was done by Levine and Lown (Levine 1952), who developed the concept of armchair mobilisation in the early 1950s. Many studies were done in the nineteen seventies to evaluate the outcome of early mobilisation and short hospital stays. Since then, hospital stays have become shorter and therapy has changed dramatically (McGovern 1996). According to ESC guidelines (ESC 2003) and ACC/AHA guidelines (ACC/AHA 2004) bed rest should be 12-24 hours after uncomplicated acute ST-elevation myocardial infarction, but this seems to be rather 'consensus-based' than evidence-based.

In contrast to the pharmacologic treatment of myocardial infarction, the influence of bed rest on outcome in patients with acute myocardial infarction has not been well examined. Resources are becoming smaller and the economic pressure is increasing. Reducing duration of bed rest and thus the length of hospital-stay to a necessary minimum after an acute myocardial infarction could reduce costs, but must not negatively influence outcome.

OBJECTIVES

To identify the effect of bed rest on clinical outcome after uncomplicated acute myocardial infarction, to determine the optimal duration of bed rest after uncomplicated acute myocardial infarction and to identify areas of the evidence base that require more work to evaluate the optimal duration of bed rest after uncomplicated acute myocardial infarction.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials and quasi randomised trials, without language restrictions.

Types of participants

Patients with acute uncomplicated myocardial infarction, according to authors' definitions.

We did not intend to make any restrictions to types of patients with regard to age, gender, race and comorbidity and to the setting. No restrictions on use of specific treatments such as fibrinolytics or early revascularisation were made.

Types of interventions

Duration of bed rest as given, transformed as feasible, most likely in hours or days. Bed rest should be defined as lying flat without permission to leave the bed for any reason.

Types of outcome measures

Primary outcome measures

- Total death (total number).
- Cause-specific death (due to coronary heart disease).
- Reinfarction.

Secondary outcome measures

- Arrhythmia.
- Thromboembolic complications.
- Cardiac wall rupture/ aneurysm.
- Duration of hospital stay.
- Quality of life.

Search methods for identification of studies

Electronic searches

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) on *The Cochrane Library* (2009, Issue 3), MEDLINE (January 1966 to October 2009), EMBASE (January 1988 to October 2009), PASCAL BioMed (January 1996 to October 2009), PsycINFO (January 1966 to August 2005) and BIOSIS Previews (January 1990 - October 2009). See [Appendix 1](#) and [Appendix 2](#) for details of the search strategies.

A highly sensitive search strategy for identifying RCTs was used with MEDLINE (Dickersin 1994) and EMBASE (Lefebvre 1996).

No language restrictions were applied.

Searching other resources

References of the retrieved articles and other relevant articles or reviews were searched for relevant citations, and experts were contacted to obtain references of relevant studies.

Data collection and analysis

Study selection

The abstracts of all search hits were read independently by at least two investigators and selected according to the inclusion criteria, using an in/out form. Inconsistencies between the independent investigators were clarified by discussion between three investigators. Full text versions of all relevant articles were obtained and were read independently by at least two investigators. Irrelevant or non-randomised studies were excluded. Inconsistencies between the independent investigators were clarified by discussion with at least three investigators.

Data extraction

Data were extracted manually onto a print-out table based on an excel spreadsheet, by two investigators independently and in duplicate. A prototype spreadsheet for data collection was designed for this purpose. After internal approval this prototype was used in a pilot phase with five studies to evaluate its feasibility, particularly for the assessment of the presumed outcome measures. Reliability, range and consistency inspections were performed. Inconsistencies between the two observers were clarified by discussion. The sampling procedure was performed according to the QUOROM guidelines (Moher 1999).

Data analysis

Continuous data are presented as given in the papers. Proportions are reported as absolute number and percentage. Odds ratios and 95% confidence intervals were calculated to measure the effect of the intervention. We investigated clinical heterogeneity by inspection of the studies. Where clinical heterogeneity was negligible, we performed a quantitative data synthesis (meta-analysis). Statistical heterogeneity was analysed by chi-squared test for heterogeneity and by using the I^2 statistic (Higgins 2003). Where statistical heterogeneity was unlikely we combined studies quantitatively using a fixed-effect models (Mantel Haenszel 1959); if it had been necessary we had intended using a random-effects model (DerSimonian 1986). To assess publication bias, funnel plot analysis (Egger 1997) was used.

Methodological quality assessment

For the quality assessment the key characteristics of study design (see below) were evaluated by two investigators independently; inconsistencies were clarified by discussion between investigators (Jüni 1999, Moher 1995).

- 1) Randomisation method.
- 2) Blinded assessment of primary outcome.
- 3) Intention to treat.

These key characteristics of study design were used for sensitivity analysis. Weighting studies according to the quality was not be performed (Jüni 1999).

RESULTS

Description of studies

Results of the search

We found 532 potentially relevant articles by searching the electronic databases. Manually searching the references of the retrieved papers identified another 12 potentially eligible studies of which four papers describing three studies were included (Abraham 1975; Beckwith 1954; Hutter 1973). Twenty-five studies were excluded because they were uncontrolled, there was no explicit statement of random allocation, because the intervention was not short versus long bed rest or because the outcome variables were physiologic measurements only (see [Characteristics of excluded studies](#)). Finally, 15 randomised and quasi-randomised controlled trials were included with 1487 participants assigned to early mobilisation and 1471 participants assigned to a longer period of bed rest.

Included studies

The period of bed rest in the early mobilisation groups ranged between 2 and 14 days, the median was 6 days. In the longer bed rest groups, patients were confined to strict bed rest for 5 to 28 days, the median was 13 days. The regimens of early mobilisation varied, ranging from simply leaving the bed on a predefined day to detailed schedules for increasingly graded exercises. See [Table 1](#) for details.

The median of the average age reported was 60 years, ranging from 52 to 67 years. The percentage of women ranged from 9% to 28%, the median being 19%. Some studies excluded people above age 70 or 75 years (Bloch 1974; Harpur 1971; Royal Infirmary 1973; West 1979). The time from acute myocardial infarction to assessment of outcome ranged from 5 days to 52 weeks (median 24 weeks). One study did not report the duration of follow up at all (Beckwith 1954). According to our protocol we used the outcome nearest to 6 months.

Most studies were published in the 1970s, the most recent study being published 1989, the oldest in 1954. Therefore, therapeutic strategies in the reported studies are not comparable to the measures employed today. The use of systemic thrombolysis was mentioned in one small study with 48 patients (Rowe 1989). The use of oral anticoagulants was described in seven studies (Abraham 1975; Beckwith 1954; Bloch 1974; Harpur 1971; Hayes 1974; Royal Infirmary 1973; West 1979), of which one described the use of aspirin (Bloch 1974).

Risk of bias in included studies

Overall the quality of reporting did not meet current standards (see [Characteristics of included studies](#)). Five studies explicitly used proper randomisation methods (Bloch 1974; Hutter 1973; Royal Infirmary 1973; Schaumann 1977; West 1979), four used the word random in the methods section but gave no detail of how the sequence was generated (Ahlmarm 1979; Greco 1976; Messin 1982; Rowe 1989), and the remaining studies used quasi-randomisation methods (Abraham 1975; Beckwith 1954; Harpur 1971; Hayes 1974; Hayes 1976; Miller 1976). Only one paper reported explicitly that the outcome was assessed in a blinded fashion (Hutter 1973) and only one study stated explicitly that the analysis was according to the intention-to-treat principle (Hutter 1973). In the remaining studies it was unclear whether patients were excluded and how this was handled.

Effects of interventions

We found 15 trials including 1487 patients assigned to early mobilisation and 1471 patients assigned to a longer period of bed rest.

In several studies only limited information on age, gender or details on diagnosis was given to help in clearly assessing the degree of clinical heterogeneity. There was some degree of variability in the durations of bed rest and modes of mobilisation. In summary we assumed, however, that studies were essentially comparable. Therefore we attempted formal meta-analysis. This was supported by the low statistical heterogeneity generally found in the analyses.

Primary outcome

Thirteen papers reported on mortality ([Analysis 1.1](#)) and three papers reported on cardiac death ([Analysis 1.2](#)). There was no evidence that duration of bed rest was associated with all cause or

cardiac death after uncomplicated myocardial infarction (RR 0.85, 95%CI 0.68 to 1.07, and RR 0.81, 95%CI 0.54 to 1.19, respectively). Eleven papers reported on reinfarction (Analysis 2.1). There was no association between the rate of reinfarction and the duration of bed rest (RR 1.07, 95%CI 0.79 to 1.44).

Secondary outcomes

Arrhythmia was reported in seven studies (Analysis 3.1). There was no difference in arrhythmia rates between short and long bed rest.

Thromboembolic complications were reported in six studies (Analysis 4.1). Some researchers took great pains to measure the presence of thrombosis, including fibrinogen scans and venography. The rate of such an event was somewhat lower in patients with shorter duration of bed rest, but this was not statistically significant.

Cardiac wall rupture/aneurysm were reported in one study only (Analysis 5.1). In 199 patients seven such events were observed, there was no significant difference between the groups.

Duration of hospital stay was not reported as an outcome in most studies but was rather a predefined item of the protocol. Duration of hospital stay has therefore been reported (Analysis 6.1), but data were not combined.

None of the studies reported on quality of life.

Publication bias

Publication bias cannot be excluded completely when looking at the funnel plot with mortality as the end point (Figure 1). It seems not very likely when looking at reinfarction as the endpoint (Figure 2). The 11 studies looking at reinfarction also assessed mortality.

Figure 1. funnel plot 1. outcome is all-cause mortality

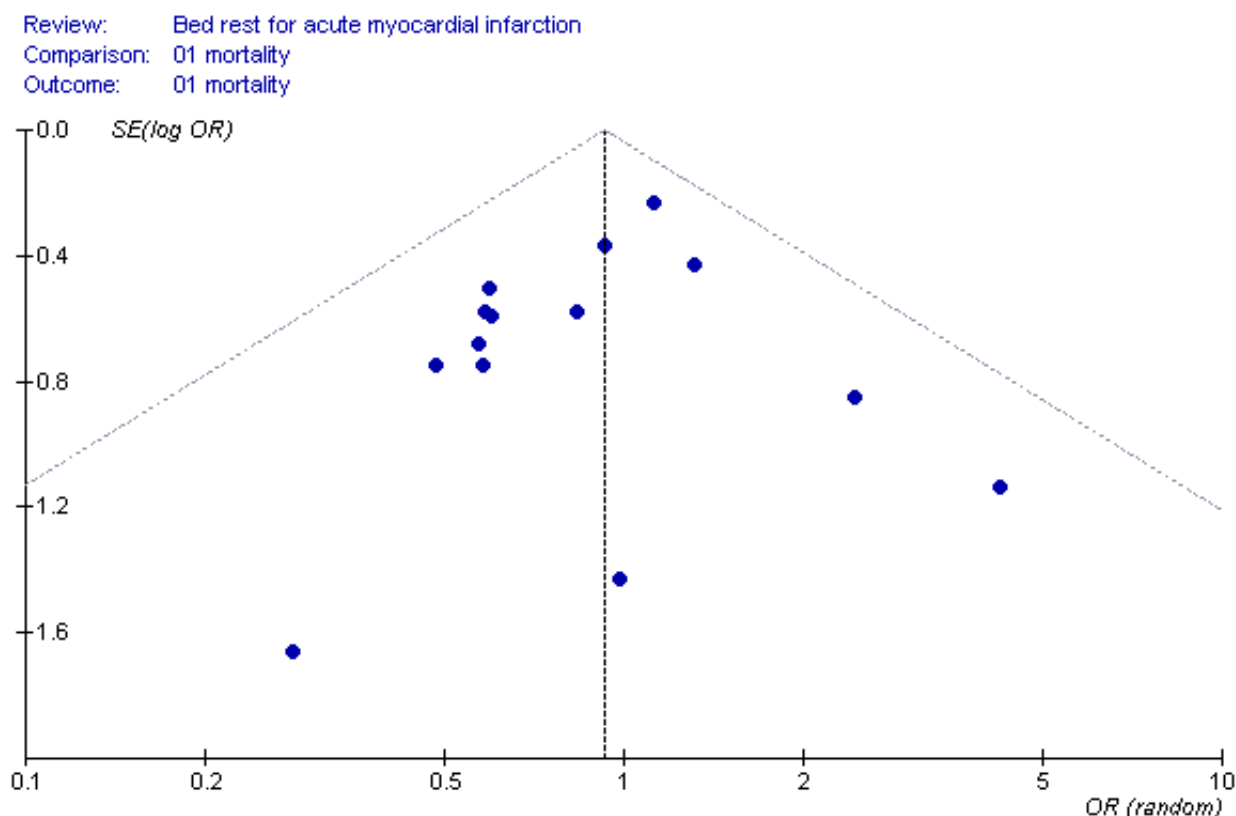
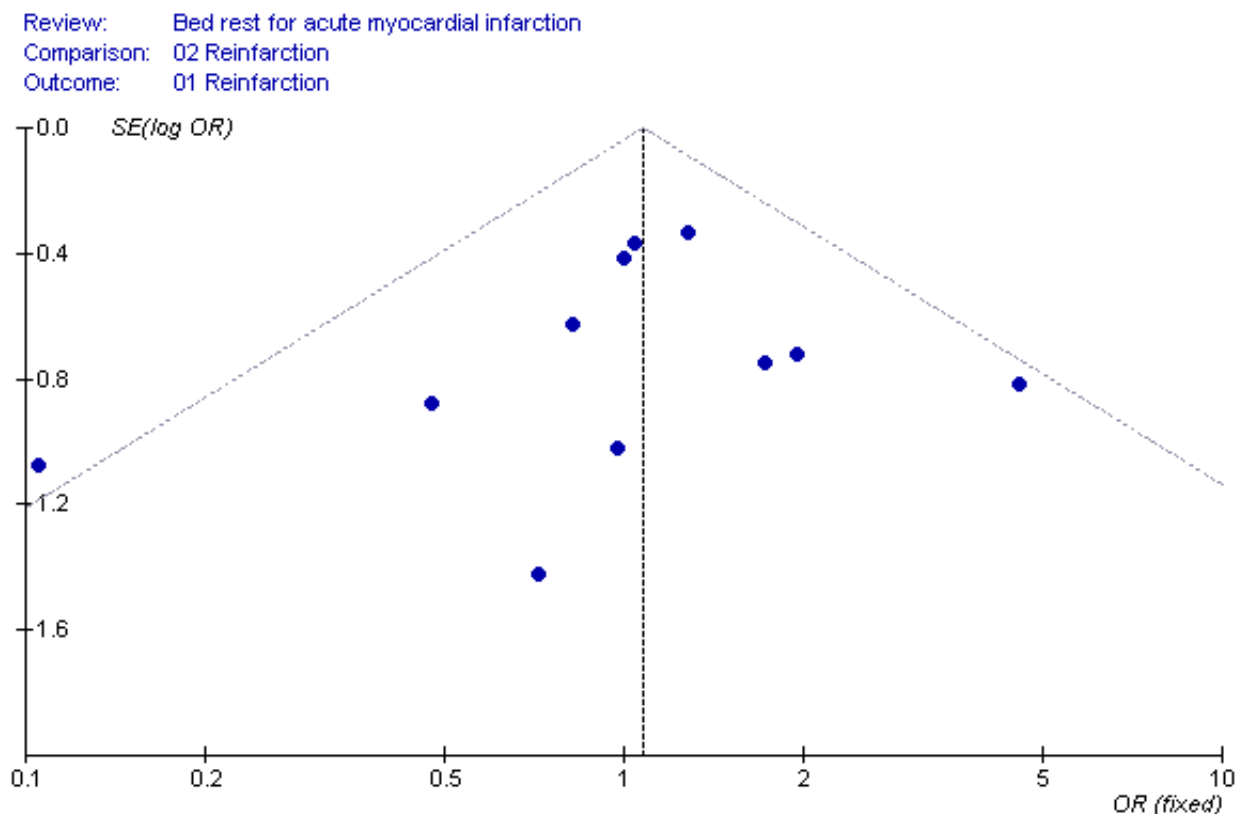


Figure 2. funnel plot 2. outcome is reinfarction



Sensitivity analysis

Sensitivity analysis to investigate the influence of trial quality on the effect of bed rest on all cause mortality yielded comparable figures: in studies reporting allocation concealment with levels A and B showed virtually the same effect as those studies with level C or D reporting (RR 0.78, 95%CI 0.56 to 1.09; and RR 0.92, 95%CI 0.66 to 1.28; respectively, [Analysis 7.1](#)). There was only one study reporting blinding of the outcome assessor and intention-to-treat analysis. This study ([Hutter 1973](#)) showed a more pronounced beneficial effect of short bed rest on mortality than the summary effect of the other studies (RR 0.60, 95%CI 0.15 to 2.41, and RR 0.85, 95%CI 0.68 to 1.07, respectively). The qualitatively best study ([Hutter 1973](#)) compared 9 with 12 days of bed rest. This is a fairly outdated comparison.

DISCUSSION

All studies investigating bed rest in acute myocardial infarction are very old and for most studies the quality of reporting is generally poor. Taking this into account, we are not able to make any inferences about the effects on clinical outcomes of contemporary much shorter durations of bed rest, nor did we find any evidence to support current policies. In the era of comparatively long durations of bed-rest, there was no evidence to support longer durations over shorter durations of bed rest. It has to be emphasised that we could not find evidence for the 12-hour bed rest as proposed by leading cardiology associations.

Potential biases and heterogeneity

It is not possible to exclude publication bias given the limited number of trials available, although it does not seem very likely. Whether a quantitative synthesis of the data is a useful exercise may be debatable: (1) the quality of reporting was in general very low and; (2) there was clinical heterogeneity, in particular concerning variable durations of bed rest in both groups. We believe however, that quantitatively combining the findings is an elegant means to summarise that shorter bed rest has no or little adverse effects, compared to longer bed rest. Of note most studies had a very small sample size, the largest containing only 742 patients.

Internal and external validity

The quality of reporting was in general not satisfactory, in particular when applying rigorous standards ([Begg 1996](#)). It is, however, impossible to say how much the quality of reporting is associated with the internal validity of these studies, because most of these studies were performed long before any reporting standards were established. It is known that studies of very low quality show an effect away from unity ([Schulz 1995](#)), but this seems not to be a problem here. We did our best to rule out any kind of publication bias and addressed heterogeneity. Thus we believe that the internal and external validity of our review is as good as could be achieved with reliance on the published reports of the trials.

Comparison with already existing meta-analyses

To the best of our knowledge there is only one other meta-analysis addressing a similar question besides a paper published version

of this review ([Herkner 2003](#)). The study by Allen et al ([Allen 1999](#)) addressed bed rest in general as a poorly evaluated, but frequently prescribed, therapy for a wide range of diseases. The study included bed rest for the treatment of acute myocardial infarction, spontaneous labour, pulmonary tuberculosis but also after interventions like lumbar puncture. They concluded that there is no evidence that bed rest as a therapy has beneficial effects. However, there are some technical and methodological shortcomings. The authors searched only MEDLINE and the Cochrane Controlled Trial Register and found only five articles. Consequently it is possible that this review was subject to publication bias, or at least may not have given the full picture. We identified an additional 11 trials, two published in other languages than English. All but one showed no difference in outcome between the groups. Further a probably non-randomised study ([Lamers 1973](#)) was included in the systematic review by Allen et al. Because of its methodological strengths and comprehensiveness we believe that our review further strengthens the findings of Allen et al ([Allen 1999](#)).

AUTHORS' CONCLUSIONS

Implications for practice

Given the limitations of the evidence, most of which is from old trials and of little relevance to contemporary clinical practice, it is not possible to make a definitive judgement on whether shorter or longer durations of bed rest are safer. Current practice has moved to markedly shorter durations of bed rest, with the most recent ACC/AHA ([ACC/AHA 2004](#)) and ESC ([ESC 2003](#)) guidelines recommending durations of no more than 12 to 24 hours bed rest. However, such advice is not based on any randomised evidence and the optimal duration of bed rest will remain unknown without further trials. It is likely that a certain minimum time in bed will always be required and that practical requirements in management of coronary care beds will determine how long this is.

Implications for research

For a frequent and dangerous disease this lack of adequate trials is quite surprising in the light of tremendously large studies to compare effectiveness of drugs ([GUSTO III](#)) for acute myocardial infarction. In the early 1980s Cochrane suggested, based on an emerging evidence, mobilising patients with uncomplicated acute myocardial infarction on the second day ([Cochrane 1981](#)). It took several years to implement this in clinical practice. Twenty years later guidelines and practice have changed accordingly. The evidence, however, has not really improved.

The next step, however, should be a survey to evaluate the patients' subjective preferences for bed rest after uncomplicated ST-elevation myocardial infarction. Based on that, strategies for bed rest other than strictly time-based schedules, like patient-determined bed rest may be of interest.

With increased use of telemetric monitoring (using wireless monitoring technologies), bed-rest is no longer mandatory for monitoring purposes. Telemonitoring would provide an opportunity to compare much shorter durations of bed-rest (< 12 hours) with longer durations (e.g. 2 days) in people with uncomplicated myocardial infarction. These trials should include assessing the effect on quality of life, because we know almost nothing about influences on this important outcome.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Abraham 1975

Methods	Allocation: admission rotation Blinding: not stated Intention-to treat: not stated
Participants	61 vs 62 years of age, 25 vs 26% female, community hospital
Interventions	5 days vs 12 days
Outcomes	52 weeks
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	High risk	C - Inadequate

Ahlmark 1979

Methods	Allocation:random Blinding: not stated Intention-to treat: no
Participants	61 vs 62 years of age, 24 vs 18% female, community hospital
Interventions	6 days vs 12 days
Outcomes	3 months
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	B - Unclear

Bed rest for acute uncomplicated myocardial infarction (Review)

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Beckwith 1954

Methods	Allocation:alternate patients Blinding: not stated Intention-to treat: not stated	
Participants	65 vs 65 years old, university hospital	
Interventions	2-5 days vs 28 days	
Outcomes		
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	High risk	C - Inadequate

Bloch 1974

Methods	Allocation: random table Blinding: not stated Intention-to treat: not stated	
Participants	58 vs 58 years of age, 17 vs 16% female, university hospital	
Interventions	8 days vs 21 days	
Outcomes	After hospital discharge	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	B - Unclear

Greco 1976

Methods	Allocation:random Blinding: not stated Intention-to treat: not stated	
Participants	58 vs 58 years of age, 7 vs 10% female, community hospital	
Interventions	6 days vs 13 days	

Greco 1976 (Continued)

Outcomes 2.7 years

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	B - Unclear

Harpur 1971

Methods Allocation: hospital rotation
Blinding: not stated
Intention-to treat: not stated

Participants 60 vs 60 years of age, 13 vs 14% female, university hospital

Interventions 7 days vs 21 days

Outcomes 8 months

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	High risk	C - Inadequate

Hayes 1974

Methods Allocation: ward rotation
Blinding: not stated
Intention-to treat: not stated

Participants 56 vs 56 years of age, 13 vs 18% female, community hospital

Interventions 2 days vs 9 days

Outcomes 6 weeks

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	High risk	C - Inadequate

Bed rest for acute uncomplicated myocardial infarction (Review)

Hayes 1976

Methods	Allocation: ward rotation Blinding: not stated Intention-to treat: not stated	
Participants	56 vs 55 years of age, 12 vs 15% female, community hospital	
Interventions	2 days vs 9 days	
Outcomes	12 days	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	High risk	C - Inadequate

Hutter 1973

Methods	Allocation: stratified randomisation Blinding: yes Intention-to treat: yes	
Participants	60 vs 60 years of age, 25 vs 28% female, university hospital	
Interventions	9 days vs 12 days	
Outcomes	24 weeks	
Notes		
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	B - Unclear

Messin 1982

Methods	Allocation: random Blinding: not stated Intention-to treat: not stated	
Participants	55 vs 55 years of age, no female, university hospital	
Interventions	4 days vs 7 days	

Messin 1982 (Continued)

Outcomes 2 years

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	B - Unclear

Miller 1976

Methods Allocation: every 3rd patient
Blinding: not stated
Intention-to treat: not stated

Participants 54 vs 54 years of age, university hospital

Interventions 1-3 days vs 5 days

Outcomes 9 days

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	High risk	C - Inadequate

Rowe 1989

Methods Allocation: random
Blinding: unclear
Intention-to treat: unclear

Participants 55 vs 57 years of age, 7 vs 10% female, community hospital

Interventions 4 days vs 7 days

Outcomes 3 months

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	B - Unclear

Bed rest for acute uncomplicated myocardial infarction (Review)

Royal Infirmary 1973

Methods	Allocation: balanced randomisation Blinding: not stated Intention-to treat: not stated
Participants	54 vs 52 years of age, 18 vs 26% female, community hospital
Interventions	6 days vs 20 days
Outcomes	1 year
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	B - Unclear

Schaumann 1977

Methods	Allocation: random; sealed envelope Blinding: not stated Intention-to treat: not stated
Participants	65 vs 65 years old, 31 vs 20% female, university hospital
Interventions	6 days vs 20 days
Outcomes	In hospital
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Low risk	A - Adequate

West 1979

Methods	Allocation: open random list Blinding: not stated Intention-to treat: not stated
Participants	60 vs 60 years of age, 18 vs 20% female, multicentre
Interventions	4 days vs 9 days

West 1979 (Continued)

Outcomes 1 year

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	High risk	C - Inadequate

vs: versus

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Armstrong 1999	Other intervention than length of bed rest, only abstract available
Bloch 1973	Other intervention than length of bed rest
Chaturvedi 1974	Other intervention than length of bed rest
Costanza 1981	Other intervention than length of bed rest
DeBusk 1982	Other intervention than length of bed rest
Fareeduddin 1969	Did not report any of the predefined endpoints, only physiologic measurements
Gelson 1976	Other intervention than length of bed rest
Gembitskii 1983	A controlled study but not explicitly stated that random allocation was used
Haviar 1968	Other intervention than length of bed rest
Hill 1978	Other intervention than length of bed rest
Krasemann 1979	Other intervention than length of bed rest
Lamers 1973	A controlled study but not explicitly stated that random allocation was used
Lau 1980	Other intervention than length of bed rest
Mather 1976	Other intervention than length of bed rest
McNeer 1978	Other intervention than length of bed rest
Newby 1996	Other intervention than length of bed rest
Newby 2000	Other intervention than length of bed rest
Pfisterer 1977	Other intervention than length of bed rest
Rechnitzer 1972	Other intervention than length of bed rest

Bed rest for acute uncomplicated myocardial infarction (Review)

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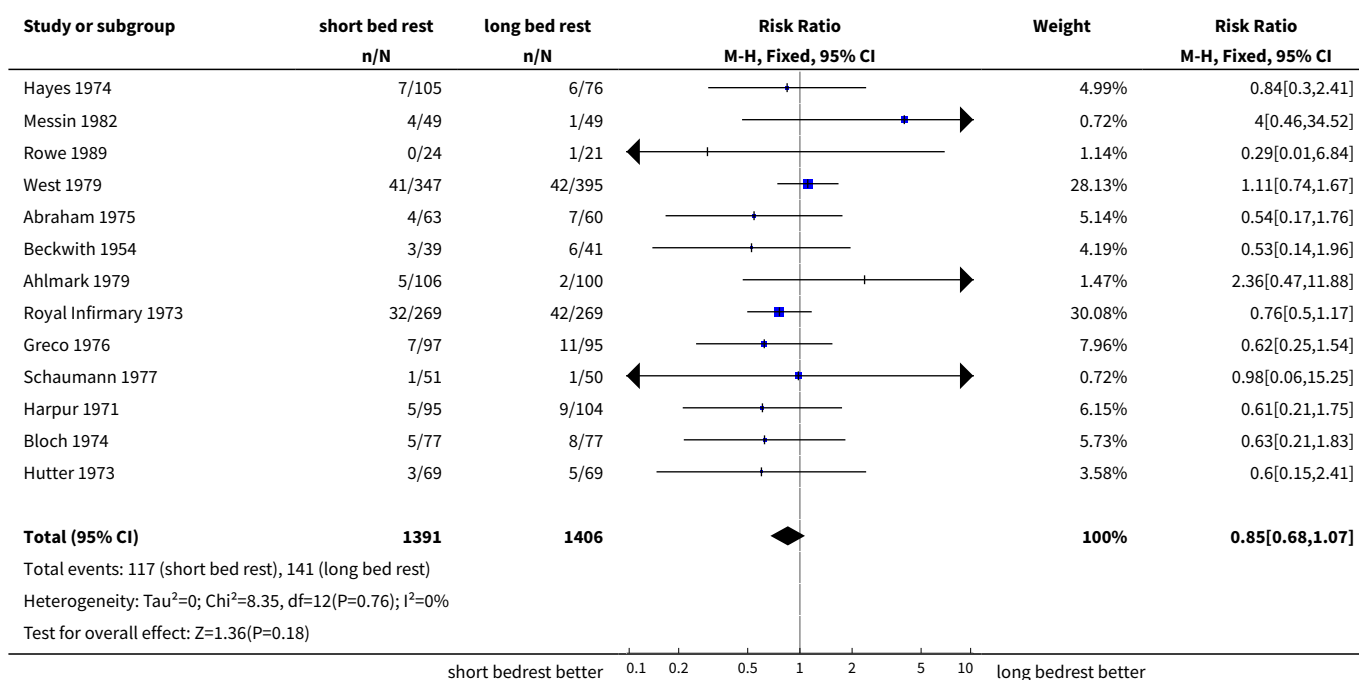
Study	Reason for exclusion
Senaratne 1999	Other intervention than length of bed rest
Simon 1974	Other intervention than length of bed rest
Stegaru 1974	Before and after design study
Stegaru 1976	None of the predefined endpoints reported, physiologic measurements only
van der Vlugt 2000	Other intervention than length of bed rest
Zdichynec 1977	A controlled study but not explicitly stated that random allocation was used

DATA AND ANALYSES

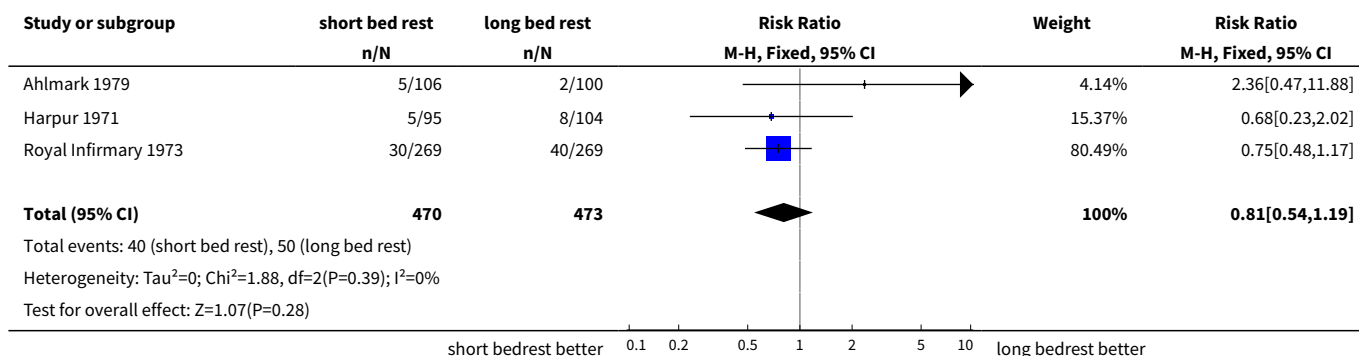
Comparison 1. Mortality

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 mortality	13	2797	Risk Ratio (M-H, Fixed, 95% CI)	0.85 [0.68, 1.07]
2 Cardiac death	3	943	Risk Ratio (M-H, Fixed, 95% CI)	0.81 [0.54, 1.19]

Analysis 1.1. Comparison 1 Mortality, Outcome 1 mortality.



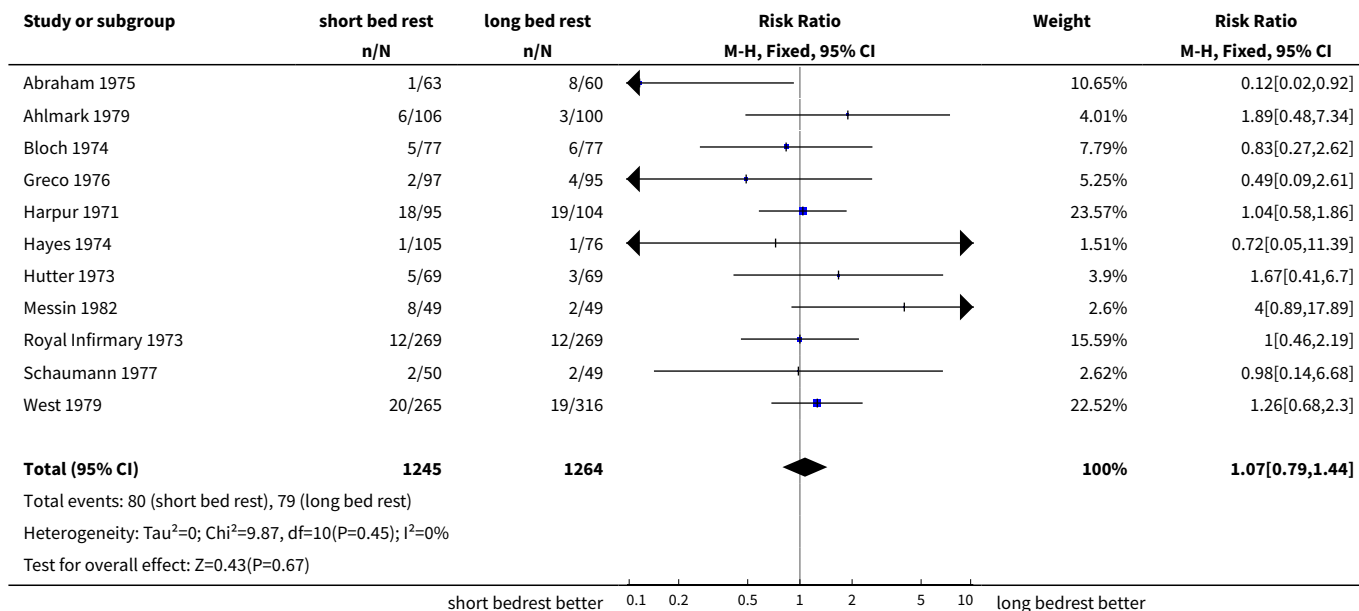
Analysis 1.2. Comparison 1 Mortality, Outcome 2 Cardiac death.



Comparison 2. Reinfarction

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Reinfarction	11	2509	Risk Ratio (M-H, Fixed, 95% CI)	1.07 [0.79, 1.44]

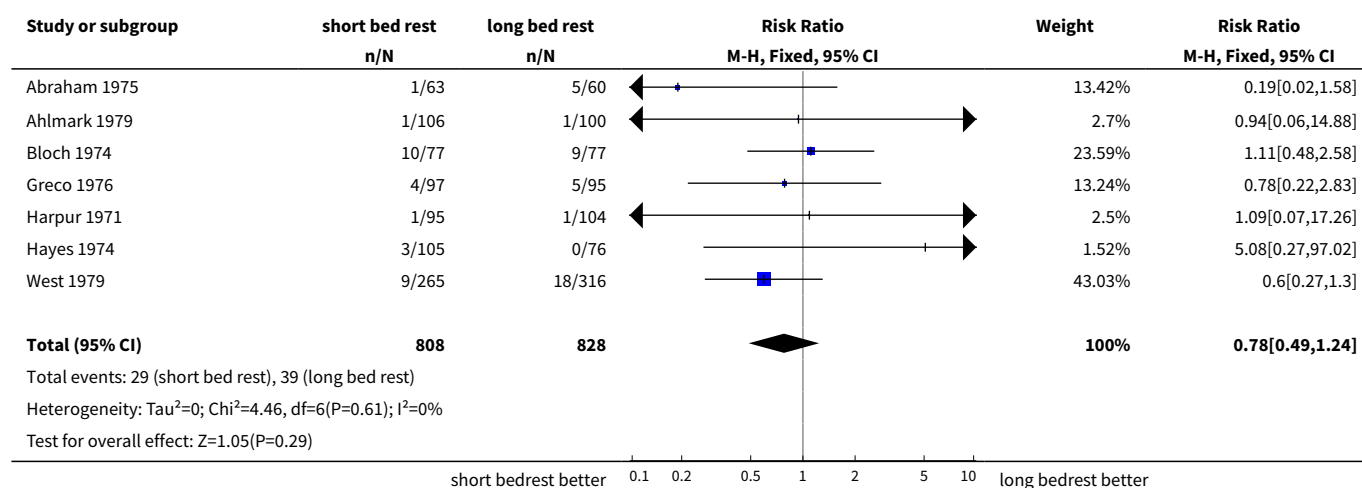
Analysis 2.1. Comparison 2 Reinfarction, Outcome 1 Reinfarction.



Comparison 3. Arrhythmia

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Arrhythmia	7	1636	Risk Ratio (M-H, Fixed, 95% CI)	0.78 [0.49, 1.24]

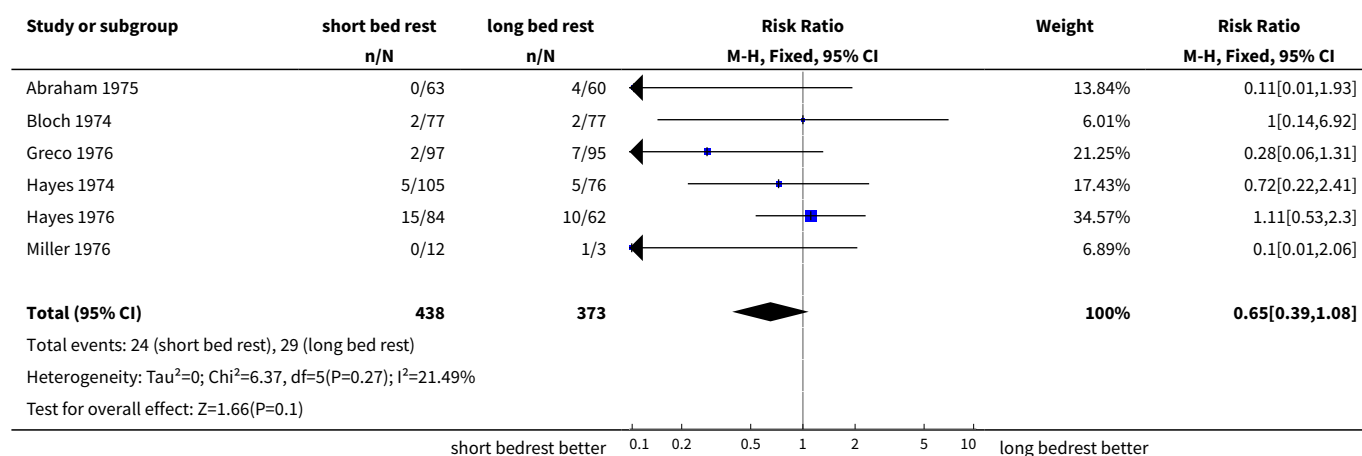
Analysis 3.1. Comparison 3 Arrhythmia, Outcome 1 Arrhythmia.



Comparison 4. Thromboembolic complications

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Thromboembolic complications	6	811	Risk Ratio (M-H, Fixed, 95% CI)	0.65 [0.39, 1.08]

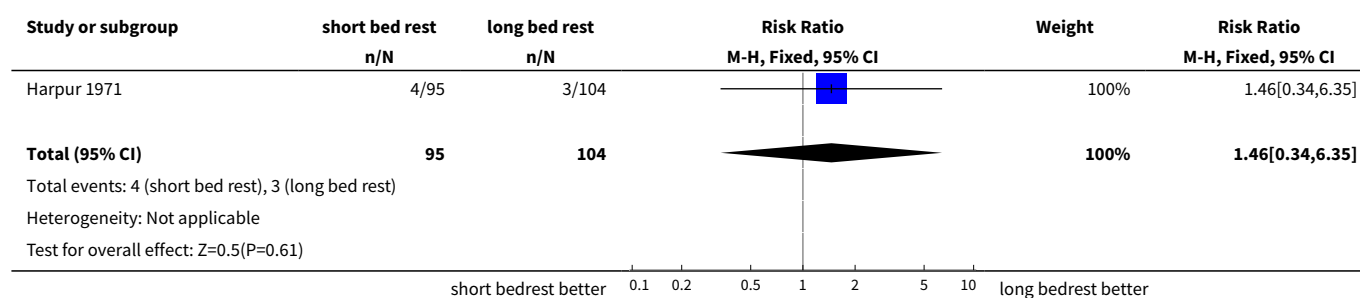
Analysis 4.1. Comparison 4 Thromboembolic complications, Outcome 1 Thromboembolic complications.



Comparison 5. Cardiac wall rupture/ aneurysm

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Cardiac wall rupture/ aneurysm	1	199	Risk Ratio (M-H, Fixed, 95% CI)	1.46 [0.34, 6.35]

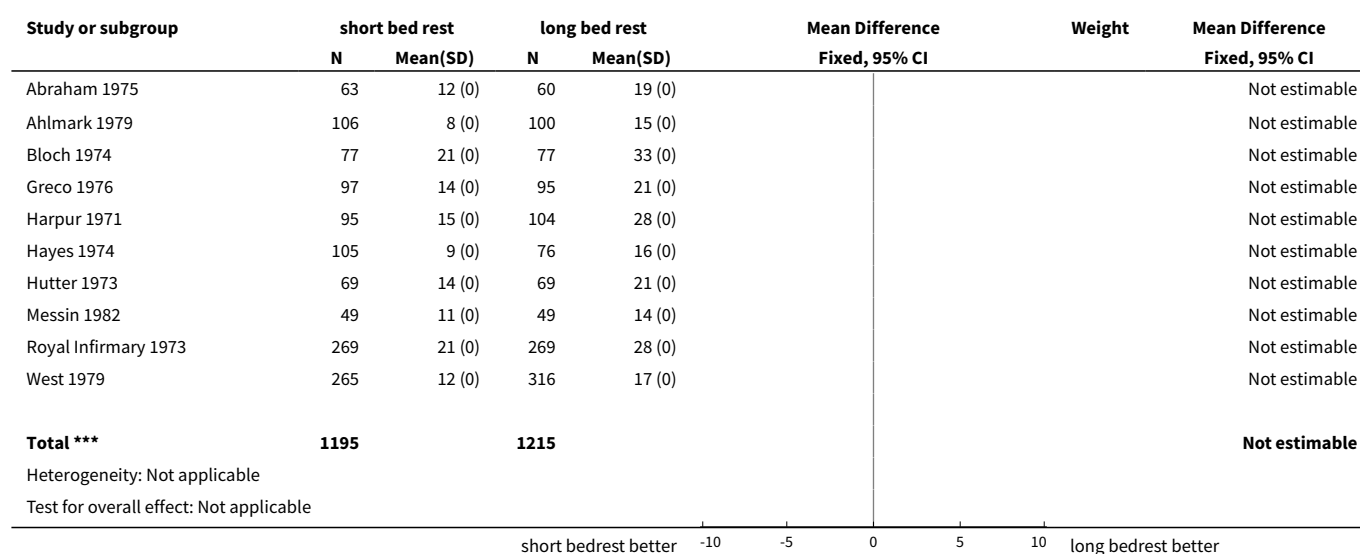
Analysis 5.1. Comparison 5 Cardiac wall rupture/ aneurysm, Outcome 1 Cardiac wall rupture/ aneurysm.



Comparison 6. Duration of hospital stay

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Duration of hospital stay	10	2410	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

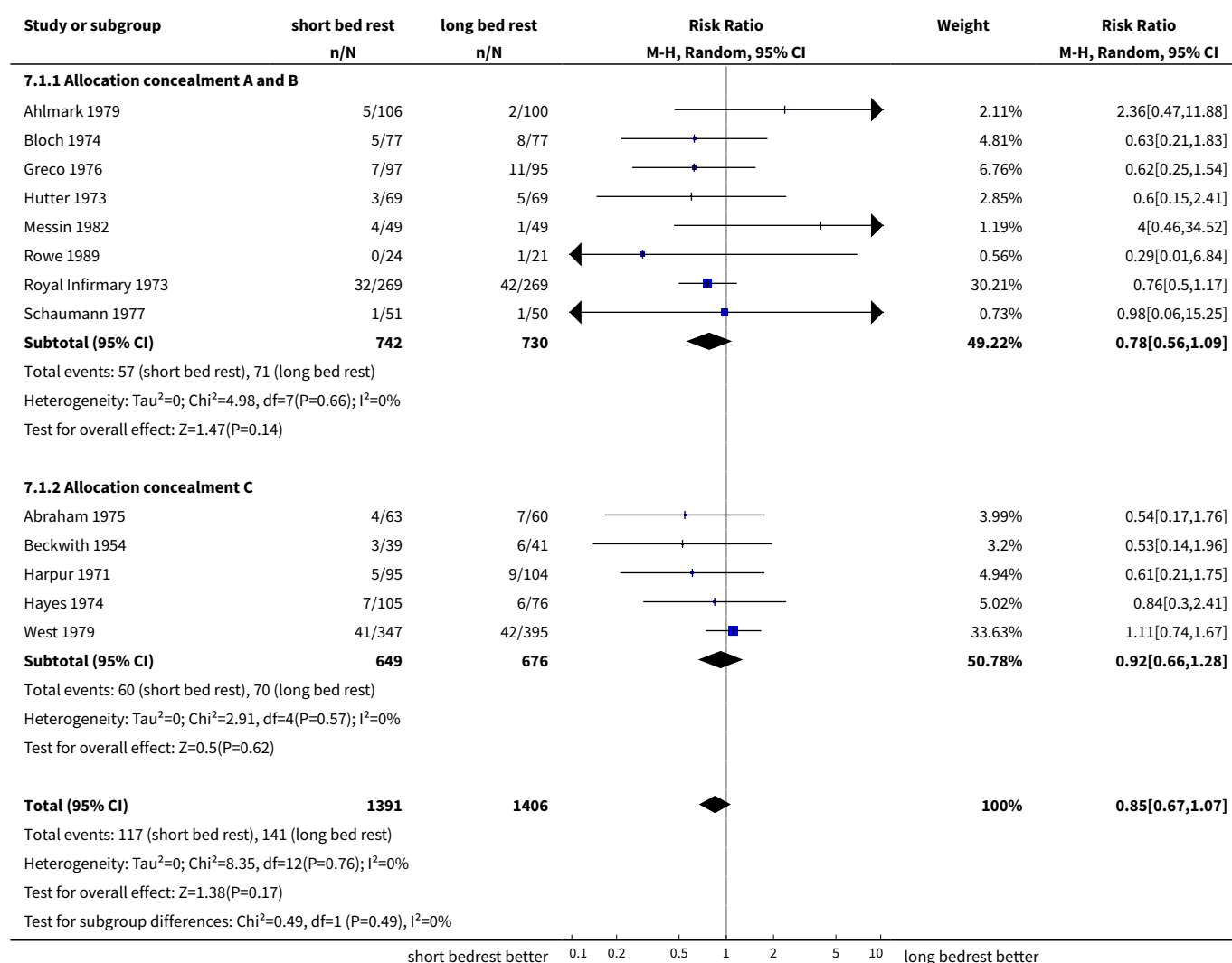
Analysis 6.1. Comparison 6 Duration of hospital stay, Outcome 1 Duration of hospital stay.



Comparison 7. Sensitivity analysis

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	13	2797	Risk Ratio (M-H, Random, 95% CI)	0.85 [0.67, 1.07]
1.1 Allocation concealment A and B	8	1472	Risk Ratio (M-H, Random, 95% CI)	0.78 [0.56, 1.09]
1.2 Allocation concealment C	5	1325	Risk Ratio (M-H, Random, 95% CI)	0.92 [0.66, 1.28]

Analysis 7.1. Comparison 7 Sensitivity analysis, Outcome 1 Mortality.



ADDITIONAL TABLES

Bed rest for acute uncomplicated myocardial infarction (Review)

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Table 1. Mobilisation Schemes

Study	Short bed rest	Long bed rest
Abraham 1975	Kept in bed for five days, allowed to use a bedside commode as soon as possible. The patients were then mobilised by sitting out of the bed: Day 6: ½ hrs twice a day Day 7: 2 hrs twice a day Day 8: all day + walk to toilet Day 9: walk around freely	Kept in bed for 12 days, allowed to use a bedside commode as soon as possible. The patients were then mobilised by sitting out of the bed: Day 13: ½ hrs twice a day Day 14: 2 hrs twice a day Day 15: all day + walk to toilet Day 16: walk around freely
Ahlmark 1979	On 4th and 5th day sit up for periods of altogether 1 ½ and 3hrs Move about ward with clothes from day 6 Discharge after day 8	Gradually mobilised after day 3 Get out of bed from day 12 Discharge after 15 days
Beckwith 1954	Start sitting in chair from day 2-5 if no pain or shock: ½ hrs 3x daily for 3 days 1 hr 3x daily for 3 days 1 ½ hrs 3x daily for 6 days Then up until day 28, bedside commode and few steps with assistance	Days 0-14 strict bed rest, no bath, shave or feeding themselves. Days 15-28 extend and flex feet bedside commode once daily.
Bloch 1974	Start 24-48 hrs after admission by physical therapist, depending on patients clinical course (a.m.= active mobilisation): I.a.m. of ankles and wrists; respiratory exercises II.a.m. of limbs, partial wash-up care in bed; dangle legs on side of bed (5min) III.a.m. in bed; bedside commode; sitting 15 min. in armchair twice a day IV.a.m. against resistance; complete care in bed; 30min. in armchair twice a day V.a.m. in bed; 1 hr in armchair twice a day; 2 short walks in room VI.-VIII. a.m. in bed; light gymnastic exercise; sitting in armchair at will; washing at the washstand; walks in corridor IX.-X as previous + exercise with footstool XI as previous + walking down 1 flight of stairs twice a day XII-XIV as previous + walking up 1-3 flights of stairs twice a day	Strict bed rest for at least 3 wks, including bedpan, with nursing service for toilet and feeding; thereafter progressive mobilisation by ward nurses
Greco 1975	Day 7-8 sit in chair 1hr twice a day Day 9 sit in chair most day Day 12 walk in room 10-15 min twice daily Day 13 walk in the yard progressively	Day 14-15 sit in chair 1hr twice a day Day 16 sit in chair most day Day 19 walk in room 10-15 min twice daily Day 20 walk in the yard progressively
Harpur 1971	Day 0-7 bed rest in any position, shave, feed themselves, use bedside commode; Day 0-3 bathed in bed by nurses Day 8 sit out of bed ½ hr once a day Day 9 sit out of bed ½ hr twice a day Day 10 sit out of bed 1 hr twice a day Day 11 sit out of bed 2 hr twice a day, walk to toilet Day 12 sit out of bed 6 hrs and for meals Day 13 up all day, deep bath Day 14 up all day, climb stairs Day 14 up all day, discharge	Day 0-14 bed rest in any position, shave, feed themselves, use bedside commode; Day 0-3 bathed in bed by nurses Day 15 sit out of bed ½ hr once a day Day 16 sit out of bed ½ hr twice a day Day 16 sit out of bed 1 hr twice a day Day 17 sit out of bed 2 hr twice a day, walk to toilet Day 18 sit out of bed 6 hrs and for meals

Table 1. Mobilisation Schemes *(Continued)*

		Day 19 up all day, deep bath Day 20 up all day, climb stairs Day 21 up all day, discharge
Hayes 1974 & Hayes 1976	Sit out of bed when transferred from coronary care unit (CCU) thereafter no restriction to activities; encouraged to walk around the ward, use ordinary ward washing and toilet facilities	Day 0-7 after transferred from CCU bed rest Sit in chair when bed was made, bedside commode Day 8-16 allowed up, encouraged to walk around the ward
Hutter 1973	Day 7-9 dangle Day 10-11 sit in chair Day 12-13 walk	Day 10-12 dangle Day 13-16 sit in chair Day 17-20 walk
Messin 1982	From 2nd day physical training (3 stages) 5th day walking 10th day climbing stairs depending on submaximal exercise test	From 2nd day physical training (3 stages) 8th day walking 21st day climbing stairs
Miller 1976	From day 0-3 sitting and standing beside bed 30 min three times a day; used bedside commode eating while sitting at the bedside	Traditional 5 days of bed rest
Rowe 1989	Day 4 walked briskly 10-15 min twice a day with physiotherapist; over three days duration and intensity of walking increased rapidly. Day 8 climbing 1-2 flights of stairs	Nursing staff observed patients to ensure inactivity
Royal Infirmary 1973	Active leg movements from 1st day encouraged day 7 sit out of bed ½ hr day 8 sit out of bed 1 hr day 9 sit out of bed 2 hrs, stand by bed 5 min. day 10 walk once around the bed day 11 walk 25 yards day 12 walk 50 yards day 13 fully ambulant in the ward	Active leg movements from 1st day encouraged day 21 sit out of bed ½ hr day 22 sit out of bed 1 hr day 23 sit out of bed 2 hrs, stand by bed 5 min. day 24 walk once around the bed day 25 walk 25 yards day 26 walk 50 yards day 27 fully ambulant in the ward
Schaumann 1977	According to WHO 1968*	Strict bed rest
West 1979	From day 5: sitting out of bed for two ½ hr periods on the 5th day with subsequently increasing activity until after one week they were out of bed for 2 hrs a day and walking on the level.	From day 10: sitting out of bed for two ½ hr periods on the 10th day with subsequently increasing activity until after one week they were out of bed for 2 hrs a day and walking on the level.
*WHO, Regional Office for Europe. A program for the physical rehabilitation of patients with acute myocardial infarction. Copenhagen: World Health Organisation, 1968.		

APPENDICES

Appendix 1. Search Strategies 2009

CENTRAL on The Cochrane Library

#1 MeSH descriptor myocardial infarction explode all trees

Bed rest for acute uncomplicated myocardial infarction (Review)

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#2 MeSH descriptor acute coronary syndrome this term only
#3 myocardial next infarct* in All Text
#4 heart next infarct* in All Text
#5 coronary next syndrome* in All Text
#6 heart next attack* in All Text
#7 coronary next thrombosis in All Text
#8 (#1 or #2 or #3 or #4 or #5 or #6 or #7)
#9 MeSH descriptor early ambulation this term only
#10 MeSH descriptor Bed Rest this term only
#11 bedrest in All Text
#12 bed next rest in All Text
#13 (confined in All Text near/3 bed in All Text)
#14 bedbound in All Text
#15 (early in All Text near/3 ambulat* in All Text)
#16 (early in All Text near/3 activi* in All Text)
#17 (early in All Text near/3 mobili* in All Text)
#18 immobili* in All Text
#19 (#9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18)
#20 (#8 and #19)

MEDLINE on Ovid

1 exp Myocardial Infarction/
2 exp Myocardial Ischemia/
3 ami.tw.
4 mi.tw.
5 myocardial infarct\$.tw.
6 acute heart infarction.tw.
7 coronary thrombos\$.tw.
8 myomala\$.tw.
9 acute coronary syndrome\$.tw.
10 heart attack\$.tw.
11 myocardial isch\$.tw.
12 post-infarction.tw.
13 or/1-12
14 Early Ambulation/
15 Bed Rest/
16 bed rest.tw.
17 bed-rest.tw.
18 bedrest.tw.
19 confined to bed.tw.
20 bedbound.tw.
21 (early adj3 ambulat\$.tw.
22 (early adj3 discharge\$.tw.
23 (early adj3 activit\$.tw.
24 (early adj3 mobili\$.tw.
25 immobili\$.tw.
26 recumb\$.tw.
27 or/14-26
28 13 and 27
29 randomized controlled trial.pt.
30 controlled clinical trial.pt.
31 Randomized controlled trials/
32 random allocation/
33 double blind method/
34 single-blind method/
35 or/29-34
36 exp animal/ not humans/
37 35 not 36
38 clinical trial.pt.
39 exp Clinical Trials as Topic/
40 (clin\$ adj25 trial\$.ti,ab.

41 ((singl\$ or doubl\$ or trebl\$ or tripl\$) adj (blind\$ or mask\$)).ti,ab.
42 placebos/
43 placebo\$.ti,ab.
44 random\$.ti,ab.
45 research design/
46 or/38-45
47 46 not 36
48 37 or 47
49 28 and 48

EMBASE on Ovid <to 2009 Week 40>

1 exp Heart Infarction/
2 ami.tw.
3 mi.tw.
4 myocardial infarct\$.tw.
5 acute heart infarction.tw.
6 coronary thrombos\$.tw.
7 myomala\$.tw.
8 acute coronary syndrome\$.tw.
9 heart attack\$.tw.
10 myocardial isch\$.tw.
11 post-infarction.tw.
12 or/1-11
13 Bed Rest/
14 bed rest.tw.
15 bed-rest.tw.
16 bedrest.tw.
17 confined to bed.tw.
18 bedbound.tw.
19 (early adj3 ambulat\$).tw.
20 (early adj3 discharge\$).tw.
21 (early adj3 activit\$).tw.
22 (early adj3 mobili\$).tw.
23 immobili\$.tw.
24 recumb\$.tw.
25 or/13-24
26 12 and 25
27 controlled clinical trial/
28 random\$.tw.
29 randomized controlled trial/
30 follow-up.tw.
31 double blind procedure/
32 placebo\$.tw.
33 placebo/
34 factorial\$.ti,ab.
35 (crossover\$ or cross-over\$).ti,ab.
36 (double\$ adj blind\$).ti,ab.
37 (singl\$ adj blind\$).ti,ab.
38 assign\$.ti,ab.
39 allocat\$.ti,ab.
40 volunteer\$.ti,ab.
41 Crossover Procedure/
42 Single Blind Procedure/
43 or/27-42
44 (exp animals/ or nonhuman/) not human/
45 43 not 44
46 45 and 26

PsycINFO on Ovid <1987 to October Week 1 2009>

1 Myocardial Infarctions/
2 coronary thromboses/

Bed rest for acute uncomplicated myocardial infarction (Review)

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3 ami.tw.
4 mi.tw.
5 myocardial infarct\$.tw.
6 heart infarction.tw.
7 coronary thrombos\$.tw.
8 myomala\$.tw.
9 coronary syndrome\$.tw.
10 heart attack\$.tw.
11 post-infarction.tw.
12 or/1-11
13 bed rest.tw.
14 bed-rest.tw.
15 bedrest.tw.
16 confined to bed.tw.
17 bedbound.tw.
18 (early adj3 ambulat\$.tw.
19 (early adj3 discharge\$.tw.
20 (early adj3 activit\$.tw.
21 (early adj3 mobili\$.tw.
22 immobili\$.tw.
23 or/13-22
24 23 and 12
25 limit 24 to yr="2005 - 2009"
26 limit 25 to human (5)

BIOSIS on ISI Web of Knowledge

#5 and #6
Databases=PREVIEWS Timespan=2005-2009
6 >TA=human
Databases=PREVIEWS Timespan=2005-2009
5 #1 and #2 and #4
Databases=PREVIEWS Timespan=2005-2009
4 TS=(randomi* or trial or control* or groups or blind*)
Databases=PREVIEWS Timespan=2005-2009
3 #1 and #2
Databases=PREVIEWS Timespan=2005-2009
2 TS=(myocardial infarct* or heart infarct* or coronary thrombosis or coronary syndrome or heart attack or post-infarction or AMI)
Databases=PREVIEWS Timespan=2005-2009
1 TS=(bedrest or bed rest or early mobili* or immobili* or early ambulation)
Databases=PREVIEWS Timespan=2005-2009

Appendix 2. Search Strategies 2005

CENTRAL

#1 MI or AMI
#2 MYOCARDIAL INFARCT*
#3 ACUTE HEART INFARCTION
#4 CORONARY THROMBOS*
#5 MYOMALA*
#6 ACUTE CORONARY SYNDROM*
#7 HEART ATTACK*
#8 MYOCARDIAL ISCH*
#9 ((((((#1 or #2) or #3) or #4) or #5) or #6) or #7) or #8)
#10 EARLY-AMBULATION*:ME
#11 BED REST
#12 BEDREST
#13 BED-REST
#14 (CONFINED near BED)
#15 BEDBOUND
#16 (EARLY near AMBULAT*)
#17 (EARLY near ACTIVIT*)

#18 (EARLY near DISCHARGE)
#19 (EARLY near MOBILI*)
#20 IMMOBILI*
#21 (((((((((#10 or #11) or #12) or #13) or #14) or #15) or #16) or #17) or #18) or #19) or #20)
#22 (#9 and #21)

MEDLINE (Silver Platter)

1 exp Myocardial Infarction/ (MeSH)
2 exp Myocardial Ischemia/ (MeSH)
3 ami
4 mi
5 myocardial infarct*
6 acute heart infarction
7 coronary thrombos*
8 myomala*
9 acute coronary syndrome*
10 heart attack*
11 myocardial isch*
12 post-infarction
13 or/ 1-12
14 Early Ambulation/ (MeSH)
15 Bed Rest/ (MeSH)
16 bed rest
17 bed-rest
18 bedrest
19 confined to bed
20 bedbound
21 (early near ambulat*)
22 (early near discharge*)
23 (early activit*)
24 (early near mobili*)
25 immobili*
26 recumb*
27 or/ 14-26
28 13 and 27

EMBASE (Silver Platter)

1 exp Heart Infarction/ (Thesaurus)
2 ami
3 mi
4 myocardial infarct*
5 acute heart infarction
6 coronary thrombos*
7 myomala*
8 acute coronary syndrome*
9 heart attack*
10 myocardial isch*
11 post-infarction
12 or/1-11
13 Bed Rest/ (Thesaurus)
14 bed rest
15 bed-rest
16 bedrest
17 confined to bed
18 bedbound
19 (early near ambulat*)
20 (early near discharge*)
21 (early activit*)
22 (early near mobili*)
23 immobili*
24 recumb*

25 or/13-24
26 12 and 25

PsycINFO (Silver Platter)

1 Coronary thromboses (Thesaurus)
2 Myocardial infarctions (Thesaurus)
3 AMI
4 MI
5 Post-infarction
6 Myocardial infarct*
7 Acute heart infarction*
8 Coronary thrombos*
9 Myomala*
10 Acute coronary syndro*
11 Heart attack
12 Myocardial isch*
13 (#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13)
14 bed-rest
15 bed rest
16 bedrest
17 early near ambulat*
18 confined to bed
19 bedbound
20 early activity
21 early near discharge*
22 early near mobili*
23 immobili*
24 recumb*
25 (#14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24)
26 (#13 and #25)
No RCT filter used.

PASCAL Biomed and BIOSIS

1 AMI
2 MI
3 Myocardial infarct*
4 Acute heart infarction
5 Coronary thrombos*
6 Myomala*
7 Acute coronary syndro*
8 Heart attack
9 Myocardial isch*
10 Post-infarction
11 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #8 OR #9 OR #10)
12 bed rest
13 bedrest
14 bed-rest
15 confined to bed
16 bedbound
17 early ambulation
18 early activity
19 early discharge
20 early mobili*
21 immobili*
22 recumb*
23 (#12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22)
24 PLACEBO*
25 randomi*
26 trial*
27 control*
28 compar*

Bed rest for acute uncomplicated myocardial infarction (Review)

29 blind*
30 clinic*
31 study
32 (#24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31)
33 #11 AND #23 AND #32

WHAT'S NEW

Date	Event	Description
5 December 2012	Review declared as stable	This review is no longer being updated as the last included study was published in 1989. So it has become a historical review.

HISTORY

Protocol first published: Issue 4, 2002
Review first published: Issue 2, 2007

Date	Event	Description
12 October 2009	New search has been performed	The search was updated in October 2009, minor changes were made to the search strategy. No new studies were identified for inclusion. The conclusions are unchanged.
8 September 2008	Amended	Converted to new review format.
5 February 2007	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

The main responsibilities were as follows:
Development of the protocol: HH and MM
Searching the literature: HH, CH and JA
Data extraction: JA and CH
Writing and reviewing and approving the manuscript: HH, MM, CH and JA

HH acts as the guarantor of the manuscript

DECLARATIONS OF INTEREST

None known

SOURCES OF SUPPORT

Internal sources

- Medical University of Vienna, Austria.

External sources

- No sources of support supplied

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The search in 2009 did not include PASCAL Biomed as we did not have access to this database.

NOTES

The last study included in this review comes from 1989, most studies were performed in the 1970's, and so represents a historical review. Should the subject become salient again it is unlikely that the contemporary studies would compare with those in this review. Almost all components of AMI therapy have dramatically changed, and the issues involved today do not compare to the issues at the time when the studies from my review were published - femoral access issues and mobilisation might serve as one example amongst many others.

INDEX TERMS

Medical Subject Headings (MeSH)

Bed Rest [*methods]; Myocardial Infarction [*therapy]; Randomized Controlled Trials as Topic; Time Factors

MeSH check words

Humans